UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/066,920	02/04/2002	Takenori Sekijima	P/1071-1539	4354

7590 03/25/2004

Edward A. Meilman
DICSTEIN SHAPIRO MORIN & OSHINSKY LLP
1177 Avenue of the America
41st floor
New York, NY 10036-2714

EXAMINER
SONG, MATTHEW J

ART UNIT	PAPER NUMBER
1765	

DATE MAILED: 03/25/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/066,920	SEKIJIMA ET AL.	
	Examiner	Art Unit	
	Matthew J Song	1765	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *09 January 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-4 and 8-17* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-4 and 8-17* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claim 8 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claim 8 recites, " A method of manufacturing a single crystal without the **necessity** of using any seed crystal" in lines 1-2. It is unclear if "without the necessity" requires or does not require the absence of a seed crystal. Furthermore, claim 11 positively recites, a seed crystal is not employed, which suggests claim 8 does not require the absence of a seed crystal.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

4. Claim 8-9 and 15-17 are rejected under 35 U.S.C. 102(b) as being anticipated by Sekijima et al (US 6,039,802) or Kimura et al (US 4,256,531).

Sekijima et al discloses a single crystal growth method, which allows single crystal to be grown stable while controlling its growth orientation. The method comprises the steps of holding

a polycrystalline rod and seed crystal within a heating furnace; heating the polycrystalline rod to form a melt zone and growing a single crystal by moving a melt zone (Abstract and Figs 1-5). Sekijima et al also discloses the polycrystalline rod may be a thin crystal having a fibrous shape of less than 3 mm in diameter (col 4, ln 15-25). Sekijima et al also discloses the single crystal growth method is self-solvent floating zone and the polycrystal is YIG or an oxide superconductor such as YBCO (col 3, ln 25-67). Sekijima et al also discloses the density of the raw material may be increased and a good quality crystal can be grown with a high yield (col 2, ln 50-67).

Kimura et al discloses a method of producing a single crystal of yttrium-iron garnet by a floating zone method (Abstract). Kimura et al also teaches the shape of the molded mixture can be any rod type as it is used in the floating zone method and a cylindrical rod having a diameter of 1 mm to 10 cm is preferable (col 4, ln 10-20). Kimura et al also discloses a molded mixture of $R_3M_5O_{12}$, where R represents Y and optionally other rare earth elements (col 4, ln 55-65 and col 2, ln 10-40). Also, Kimura et al teaches the size of the rod and single crystal product has approximately the same size (col 7, ln 1-35).

Sekijima et al or Kimura et al is silent to the crystal grows in the direction normal to the densest surface. However, this is inherent to Sekijima et al or Kimura et al because Sekijima et al or Kimura et al discloses a similar method of float zone growth. Also the molten zone is inherently less dense than a growing single crystal therefore the growth inherently occurs in a direction normal the growing single crystal, the densest surface.

Referring to the limitation of "manufacturing a single crystal without the necessity of using any seed crystal", the Examiner has interpreted this to mean a seed crystal can be present

and method merely is required to be able to be preformed without a seed crystal. Therefore, because Sekijima et al or Kimura et al discloses a similar method of melting a polycrystalline rod to form a molten zone and then cooling and solidifying the molten zone using the Float Zone method, as applicants, note instant claim 9, the method disclosed by Sekijima et al or Kimura et al inherently does not require the use of a seed crystal. Furthermore, zone melting of a polycrystalline rod to form a monocrystalline rod is known to be able to be preformed without a seed crystal, note Baghdadi et al (US 4,196,041) column 1, lines 20-35.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

6. Claims 1, 2, 3, 8, 9 and 11-17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sekijima et al (US 6,039,802) or Kimura et al (US 4,256,531) in view of Baghadi et al (US 4,196,041).

Sekijima et al discloses a single crystal growth method, which allows single crystal to be grown stable while controlling its growth orientation. The method comprises the steps of holding a polycrystalline rod and seed crystal within a heating furnace; heating the polycrystalline rod to form a melt zone and growing a single crystal by moving a melt zone (Abstract and Figs 1-5). Sekijima et al also discloses the polycrystalline rod may be a thin crystal having a fibrous shape of less than 3 mm in diameter (col 4, ln 15-25). Sekijima et al also discloses the single crystal growth method is self-solvent floating zone and the polycrystal is YIG or an oxide superconductor such as YBCO (col 3, ln 25-67). Sekijima et al also discloses the density of the raw material may be increased and a good quality crystal can be grown with a high yield (col 2, ln 50-67).

Kimura et al discloses a method of producing a single crystal of yttrium-iron garnet by a floating zone method (Abstract). Kimura et al also teaches the shape of the molded mixture can be any rod type as it is used in the floating zone method and a cylindrical rod having a diameter of 1 mm to 10 cm is preferable (col 4, ln 10-20). Kimura et al also discloses a molded mixture of $R_3M_5O_{12}$, where R represents Y and optionally other rare earth elements (col 4, ln 55-65 and col 2, ln 10-40). Also, Kimura et al teaches the size of the rod and single crystal product has approximately the same size (col 7, ln 1-35).

Sekijima et al or Kimura et al does not teach manufacturing a single crystal without using any seed crystal.

In a method of converting a polycrystalline sheet into a monocrystalline sheet, note entire reference, Baghdadi et al teaches a method of forming a monocrystalline material from a polycrystalline material without requiring the use of a seed crystal. Baghdadi et al teaches the formation of a region of a sheet having a small width compared to the width of the remainder of the sheet and a molten zone is formed in the small width region of the sheet, which is allowed to solidify into a single crystal (Abstract and col 1, ln 20-35). Baghdadi et al also teaches the method is low in cost and a high volume process (col 1, ln 35-50 and col 4, ln 35-40). Baghdadi et al also teaches other semiconductor materials and compound semiconductor materials and the like may be employed (col 2, ln 30-40). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Sekijima et al or Kimura et al with Baghdadi et al's method of forming a single crystal using a molten zone method, which does not require a seed crystal, because the process is inexpensive and capable of high volume (col 1, ln 35-45), which is desirable.

The combination of Sekijima et al and Baghdadi et al or the combination of Kimura et al and Baghadi et al is silent to the crystal grows in the direction normal to the densest surface. However, this is inherent to the combination of Sekijima et al and Baghdadi et al or the combination of Kimura et al and Baghadi et al because the combination of Sekijima et al and Baghdadi et al or the combination of Kimura et al and Baghadi et al teaches a similar method of float zone growth. Also the molten zone is inherently less dense than a growing single crystal therefore the growth inherently occurs in a direction normal the growing single crystal, the densest surface.

Referring to claim 8, the Examiner has interpreted the claim to require a process of forming a single crystal, which does not use a seed crystal, and a method of forming a single crystal without using a seed crystal is taught by Baghadi et al.

7. Claims 4 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sekijima et al (US 6,039,802) or Kimura et al (US 4,256,531) in view of Baghadi et al (US 4,196,041) as applied to claims 1-3, 8-9 and 11-17 above, and further in view of Cordova-Plaza et al (US 5,082,349) or Kobayashi et al (US 4,323,418).

The combination of Sekijima et al and Baghadi et al or the combination of Kimura et al and Baghadi et al teaches all of the limitations of claim 4, as discussed previously, except that step (b) is performed using the Laser Heated Pedestal Growth Method.

In a method of manufacturing single crystals, Cordova-Plaza et al teaches single crystal fibers have been manufactured using the laser heated pedestal growth method, a variant of the float zone process. And in such a method, the upper end of a source rod of crystal material is heated with a focused laser beam (col 2, ln 1-67). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Sekijima et al and Baghadi et al or the combination of Kimura et al and Baghadi et al with Cordova-Plaza et al's laser heated pedestal growth method utilizing a laser beam to form a molten zone because heating with a laser beam to form a molten zone is well known variant to the float zone method of crystal growth.

In a method of growing single crystals, note entire reference, Kobayashi et al teaches a floating zone technique, where a feed rod is heated into a molten zone by radio frequency

heating or laser heating, this reads on applicant's laser heated pedestal growth method, and the molten zone is transferred, thereby turning the feed rod into a single crystal (col 1, ln 10-55). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Sekijima et al and Baghadi et al or the combination of Kimura et al and Baghadi et al's heating with Kobayashi's laser heating because substitution of known equivalents for the same purpose is held to be obvious (MPEP 2144.06).

8. Claims 1-3 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kou (US 5,114,528).

Kou teaches a method of forming a monocrystalline body from a polycrystalline feed rod by floating zone refining such that a molten zone is caused to traverse the polycrystalline rod to convert the polycrystalline rod to a monocrystalline body (claim 1). Kou also teaches the formation of $NaNO_3$ crystal rods using polycrystalline $NaNO_3$ feed rods 6 mm in diameter prepared by casting and a shaper provided with holes for melt flow of 1 and 2 mm in diameter, this reads on applicant's fiber shaped crystal, which is 3 mm or smaller in diameter. Kou also teaches the density of feed rod is expected to significantly different from that of the crystal (col 9, ln 10-68). Kou also teaches no single crystal seeds were required to grow single crystals of $NaNO_3$ (col 10, ln 19-22). Kou also discloses a heater is formed of a RF induction coil (col 7, lm 30-40).

Kou is silent to the shape of the single crystal is a fiber shaped single crystal and is 3 mm or smaller in diameter. Changes in shape are held to be obvious (MPEP 2144.03). Furthermore, a

fiber shaped single crystal, which is 3 mm or smaller in diameter is well known in the art, note Sekijima et al (US 6,039,802) and Kimura et al (US 4,256,531) above.

Kou is silent to the crystal grows in the direction normal to the densest surface. However, this is inherent to Kou because Kou teaches a similar method of float zone growth. Also the molten zone is inherently less dense than a growing single crystal therefore the growth inherently occurs in a direction normal the growing single crystal, the densest surface.

Referring to claim 2, Kou teaches forming a $NaNO_3$, which is reads on applicants' oxide single crystal because $NaNO_3$ contains oxygen.

Response to Arguments

9. Applicant's arguments with respect to claims 1-4 and 8-17 have been considered but are moot in view of the new ground(s) of rejection.

10. Applicant's arguments filed 1/9/2004 have been fully considered but they are not persuasive.

Applicants' arguments against the Kou reference are noted but are not found persuasive. Applicants allege that Kou does not teach a fiber shaped single crystal of 3 mm or smaller in diameter. The Examiner admitted in the rejection that Kou does not teach this feature. However, changes in size and shape are held to be obvious. Also, forming single crystals of 3 mm or smaller in float zone processes is well known in the art as evidenced by Sekijima et al (US 6,039,802) and Kimura et al (US 4,256,531). Furthermore, Applicants have not properly rebutted the prima facia case of obviousness established by the Examiner by providing persuasive evidence that the particular feature is significant, note MPEP 2144.04. Applicants also allege that

Kou teaches a nitrate single crystal and not an oxide single crystal. Kou does teach a nitrate, as suggested by applicants, however the nitrate , $NaNO_3$, reads on applicants' oxide single crystal. Merriam-Webster's' dictionary defines an oxide to be a binary compound of oxygen with a more electropositive element or group. Therefore, the $NaNO_3$ single crystal reads on applicants' oxide crystal because $NaNO_3$ is compound containing oxygen and Na is a more electropositive element, which by definition is an oxide.

Applicants argument that the crystal grows in a direction normal to the densest surface is not inherent to the prior art of record is noted but is not found persuasive. Applicants allege that inherency cannot be based on an assertion that methods of similar patents or an assumed density of various zones. The Examiner maintains that a crystal grows in a direction normal to the densest surface is inherent to a float zone process, because the process is similar to that which is taught by applicants and the prior art of record. Also, applicants have not properly rebutted the Examiners inherency position. Once the Examiner presents evidence or reasoning tending to show inherency, the burden shifts to the applicant to show an unobvious difference (MPEP 2112), which the applicants have not shown.

Conclusion

11. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Asahi et al (US 5,871,580) teaches vertical Bridgman and vertical gradient freeze method of single crystal growth does not require a seed crystal (col 1, ln 10-30).

Wysocki et al (US 5,069,743) teaches a method of making a single crystal without using a seed crystal in a floating zone method (col 5, ln 15-20 and Abstract).

Merriam-Webster's Dictionary defines oxide to mean a binary compound of oxygen with a more electropositive element or group (pg 832).

Kimata et al (JP 05-025148) teaches an organic single crystal formed using the Bridgman-Stockburger method to form a crystal of 3 mm in diameter (Abstract).

Okazaki et al (US 4,981,613) teaches single crystals formed by the Bridgman method having a diameter of 2 micrometers (col 15, ln 35-50).

12. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew J Song whose telephone number is 571-272-1468. The examiner can normally be reached on M-F 9:00-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on 571-272-1465. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Matthew J Song

Examiner
Art Unit 1765

MJS

NADINE G. NORTON
SUPERVISORY PATENT EXAMINER